

Reviews and Bibliographical Notices.

Animal intelligence. By GEORGE J. ROMANES, M.A., LL.D., F.R.S. International Scientific Series : Appleton & Co., New York.

This work is intended to be to the science of comparative psychology in particular what classification is to science in general ; it is a preliminary grouping of the data of its subject with a view to their subsequent organization as scientific doctrine. The author promises a complementary treatise on the evolution of mind, to deal from the stand-point of mental development with the generic relationships of the several orders, classes, and subdivisions of the animal kingdom.

The present work, therefore, must be valued not only for what it is, but also for what it makes possible, which we ought justly to remember in estimating our indebtedness to Dr. Romanes for this one of his many services to biology.

Being in actual scope merely a sorting of raw material, the work necessarily partakes of the anecdotal character of previous contributions to the subject, but, as will be divined, has little in common with them in aim and intention. Looking to the elevated purpose for which it has been compiled, we were especially solicitous to know the principles adopted by the author to direct him in the selection of facts, and these principles, clearly stated in the preface, we find, while not being too exclusive, are rigorous enough to prevent the insinuation of material errors.

One other purpose actuating the author was to produce "something resembling a text-book of the facts of comparative psychology to which men of science and also metaphysicians may turn whenever they may have occasion to acquaint themselves with the particular level of intelligence to which this or that species of animal attains." But without the forthcoming complementary

work this object will not be completely realized. It is not sufficient to mark the intellectual quality of mental actions by placing them in this or that empirical category. A true appraisement is possible only by first determining their position in the phylogeny of mind.

The introduction is occupied among other distinctions with the distinctions between mental and non-mental adaptive actions, and Dr. Romanes supplies a criterion which he thinks "is practically adequate, as it is theoretically legitimate."

"Objectively considered, the only distinction between adaptive movements due to reflex action and adaptive movements due to mental perception consists in the former depending on inherited mechanisms within the nervous system being so constructed as to effect particular adaptive movements in response to particular stimulations, while the latter are independent of any such inherited adjustment of special mechanisms to the exigencies of special circumstances." We differ from the author with much unwillingness, but this criterion seems to us both theoretically defective and practically inapplicable. Is reflex or non-mental action in its multiform manifestations necessarily inferior to or an incipient stage of conscious intelligence, as Dr. Romanes would appear to think from the above quotation and its context? Is it not rather that reflex action is a deeply engrained mental process, whether inherited or not; and as frequently as the reverse, that mind is reflex action in the making? The familiar instances are innumerable where conscious and purposive movements have become by repetition reflex or automatic during the life of the individual; where, then, in such cases are the inherited mechanisms? We think the author's conception of reflex action misses its essential relations as a phase of mental development.

Dr. Romanes' definition of instinct "is reflex action into which there is imported the element of consciousness. The term is therefore a generic one, comprising all those faculties of mind which are concerned in conscious and adaptive action antecedent to individual experience without necessary knowledge of the relation between means employed and ends attained, but similarly performed under similar and frequently recurring circumstances by all the individuals of the same species."

Reason or intelligence is defined as "the faculty which is concerned in the intentional adaptation of means to ends. It therefore implies the conscious knowledge of the relation between means employed and ends attained, and may be exercised in

adaptation to circumstances novel alike to the experience of the individual and to that of the species."

Apart from minor objections to the above definition of instinct, that which is here given as the most conspicuous of the differences between it and reflex action is, we think, one of the least conspicuous, because, being wholly subjective, it is beyond the range of perception. As Mr. Spencer has shown, reflex action, instinct, and reason are degrees of the same process; reflex action passing into instinct, and instinct passing into reason by imperceptible gradations. Hence the difficulties encountered by Dr. Romanes in the body of the work when phenomena have to be interpreted. In the chapter on the psychology of the rodents, the author is constrained to say of the beaver, that "there is no animal—not even excepting the ants and bees—where instinct has risen to a higher level of far-reaching adaptation to certain constant conditions of environment, or where faculties undoubtedly instinctive, are more puzzlingly wrought up with faculties no less undoubtedly intelligent. So much is this the case that, as we shall presently see, it is really impossible by the closest study of the psychology of this animal, to distinguish the web of instinct from the woof of intelligence; the two principles seem here to have been so intimately woven together, that in the result, as expressed by certain particular actions, it cannot be determined how much we are to attribute to mechanical impulse, and how much to reasoned purpose."

The only distinctions between reflex action and instinct, which would be at once scientifically valid and available in practice, are those relating to the *specially and complexity* of the neuro-muscular adjustments.

Beginning with the lowest forms of reflex action, where the correspondences between external phenomena and the organism are few and simple, the progress is to higher and higher forms, until simple reflex action merges into instinct or compound reflex action, with correspondences many and complex. And the continuity between instinct and reason is of the same nature. Mr. Spencer remarks ("Principles of Psychology," p. 453, vol. i.) that, "the impossibility of establishing any line of demarcation between the two may be clearly demonstrated. If every instinctive action is an adjustment of inner relations to outer relations, and if every rational action is also an adjustment of inner relations to outer relations: then, any alleged distinction can have no other basis than some difference in the characters of the relations to which the adjust-

ments are made. It must be that, while in instinct the correspondence is between inner and outer relations, that are very simple or general ; in reason, the correspondence is between inner and outer relations that are complex, or special, or abstract, or infrequent. But the complexity, speciality, abstractness, and infrequency of relations are entirely matters of degree."

The reverse aspect of this ascending transition of reflex action to reason through instinct and memory, when illuminated by the facts of the volume before us, acquires fresh interest and importance. If deliberative actions frequently repeated tend to become automatic, the absence of any uniformity in the distribution of the reasoning and instinctive faculties is what we might expect. The rabbit has not the elaborate instincts or the intelligent adaptiveness of some ants, and we learn even of the Protozoa : "There is a common and well-known rotifer whose body is of a cup-shape, provided with a very active tail, which is armed at its extremity with strong forceps. I have seen a small specimen of this rotifer seize a much larger one with its forceps, and attach itself by this means to the side of the cup. The large rotifer at once became active, and swinging about with its own forceps, began the most extraordinary series of movements, which were obviously directed toward ridding itself of the encumbrance. It dashed from side to side in all directions with a vigor and suddenness which were highly astonishing, so that it seemed as if the animalcule would either break its forceps or wrench its tail from its body." If we join these special facts and others to be found in this work with more general considerations, it would seem probable that mind is from first to last of the nature of intelligence, and that reflex action and instinct are the selected products of the more constant conditions in space and time.

In the closing chapter we have interesting and able notes, by the author's sister, on the intelligence of the brown capuchin monkey, *Celus fatuellus*. The value of these notes would have been enhanced by observations on emotional expression, and if a more extensive and varied use had been made of the experimental method.

By the scientific student this work will be welcomed as an important contribution to psychology ; to the general reader it is a replete repertory of fascinating and instructive story.

C. P. M.